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DIAGNOSTIC IMPLICATION OF MEAN PLATELET VOLUME IN THROMBOCYTOPENIA

Pathology

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ABSTRACT

Introduction: Thrombocytopenia is the most common cause of abnormal bleeding which occurs either due to hyperdestruction of platelets in peripheral circulation or due to hypoproduction of platelets from bone marrow suppression. Bone marrow examination is the ideal procedure to identify the cause but it is painful and invasive. Alternative options like Mean platelet volume (MPV) and other platelet indices can be used. They provide valuable information regarding morphology and maturity of platelets. **Method:** 225 cases of thrombocytopenia which were divided into 2 groups (Group A: Hyperdestructive thrombocytopenia and Group B: Hypoproductive thrombocytopenia) and 200 controls having normal platelet count were studied. Mean MPV was calculated for all and results were compared. **Result:** Group A showed higher MPV (10.2 fl) than group B (8.7 fl) and control group (9.1 fl). The results were statistically significant. **Conclusion:** MPV can be used as a reliable tool to differentiate between categories of thrombocytopenia. It is a non-invasive and cost-effective method.

KEYWORDS

Thrombocytopenia, Mean platelet volume (MPV), Platelet indices.

INTRODUCTION

Thrombocytopenia is subnormal number of platelets in circulating blood. It is the commonest cause of abnormal bleeding observed in various disorders of different etiologies.[10] Platelets below normal level confirms the presence of thrombocytopenia but mechanism is unknown. It is important to decide whether thrombocytopenia is due to accelerated platelet destruction or deficient platelet production.[2,6]

The cause for thrombocytopenia is diagnosed by bone marrow examination which shows megakaryocytic hyperplasia in increased peripheral destruction of platelets and megakaryocytic hypoplasia in decreased production.[3] But it is an invasive method.[4,7]

Newer automated hematology analyzers offer various platelet indices like MPV, platelet distribution width (PDW) and platelet large cell ratio (P-LCR) which can be assessed to determine the cause of thrombocytopenia.[2,6]

MPV is average size of platelets. The normal value of MPV is 7-11 fl.[3] MPV is generally on higher side in cases of thrombocytopenia occurring due to increased peripheral destruction of platelets.[9,10] Bone marrow tries to compensate for this by releasing immature platelets into circulation which are larger than normal thus, they have higher MPV.[3] These are functionally more active.[6] This parameter is efficiently sensitive and specific.[5,8]

We have undertaken this study to assess the implication of MPV for categorizing the mechanisms of thrombocytopenia.

METHOLOGY

The present study was carried out in Pathology department of Civil Hospital, Ahmedabad, Gujarat, India. It consisted 225 cases of thrombocytopenia. 200 controls were chosen with all normal parameters. Detailed history was obtained including age, gender and clinical diagnosis. Hematological analysis was done on Horiba Yumizen-2500 automated hematology analyzer with blood samples collected in K_3-EDTA vacutainers. Test was performed within 2 hours of collection. Cases which showed platelet count and platelet parameters with graphs were considered for the study. Each case of thrombocytopenia was studied by peripheral smear examination also. Incidence of thrombocytopenia according to age and gender was studied. All cases were divided into 2 groups based on the predominant mechanism of thrombocytopenia; Group A: Hyperdestructive and Group B: Hypoproductive thrombocytopenia. Proportion, mean and standard deviation were calculated. Data was analyzed and test of significance was applied.

RESULT

Out of 225 cases of thrombocytopenia, 114 cases (50.6 %) were females and 111 cases (49.3 %) were males. Age ranged from 6 months to 80 years. Most cases of TCP were observed between 21-30 years of age accounting for 46 cases (20.4 %) followed by 31-40 years of age accounting for 45 cases (20 %).
(Table 1 below)

Table 1: Age And Gender Distribution

Age (Years)	No. Of Cases	Male	Female	%
<1	23	15	8	10.2
1-10	22	13	9	9.7
11-20	23	11	12	10.2
21-30	46	16	30	20.4
31-40	45	20	25	20
41-50	29	14	15	12.8
51-60	16	8	8	7.1
61-70	15	10	5	6.6
71-80	6	4	2	2.6
Total	225	111	114	100

Group A constituted majority of the cases which were 177 out of 225 cases (78.6 %). This group was further subdivided according to clinical diagnosis. In this group, maximum cases were of bacterial infections, which were 61 (27 %) followed by liver diseases (12 %) then viral infections (10 %). All subgroups of group A had variable mean MPV with highest MPV in Immune thrombocytopenic purpura (ITP) subgroup (12.02±1.7 fl).

Group B constituted 48 out of 225 cases (21.3 %). This group was also subdivided according to the clinical diagnosis. Majority of the cases were of anemia which were 30 (13.3 %) followed by leukemia (7 %) then aplastic anemia (0.4%). Mean MPV was variable in this group also, with highest in leukemia (9.1±1.6 fl).
(Table 2 below)

Table 2: Mean Mpv In Hyperdestructive (group A) And Hypoproductive (group B) Thrombocytopenia

GROUP A: HYPERDESTRUCTIVE THROMBOCYTOPENIA (78.6 %)				
Categories	No. of Cases (Total = 177)	%	Mean Platelet Count Lakhs/ cumm	Mean MPV in fl (Mean ± SD)
Bacterial infection	61	27.1	0.60	10.1±1.2
Viral infection including Dengue	24	10.6	0.76	10.3±1.3

Malaria	15	6.6	0.58	10.1±1.3
ITP	4	1.7	0.29	12.02±1.7
Liver diseases	28	12.4	0.70	9.6±1.9
Kidney diseases	14	6.2	0.72	9.9±1.5
Cardiac diseases	7	3.1	0.51	10.2±1.2
Pregnancy	9	4	0.96	11.4±1.2
Others	15	6.6	0.65	8.9±1.1
Mean ± SD			0.64±0.17	10.2±0.9
GROUP B: HYPOPRODUCTIVE THROMBOCYTOPENIA (21.3 %)				
Categories	No. Of Cases (Total = 48)	%	Mean Platelet Count (Lakhs/cumm)	Mean MPV in fl (Mean ± SD)
Anemia	30	13.3	0.70	8.8 ±0.7
Leukemia	17	7.5	0.51	9.1 ±1.6
Aplastic anemia	01	0.4	0.38	8.4
Mean ±SD			0.52±0.13	8.7±0.35

200 controls were taken with normal platelet count out of which 112 (56 %) were males and 88 (44 %) were females. The mean platelet count in control group was 1.72±0.12 lakhs/cumm while mean MPV was 9.1±0.55 fl.

It can be noted that group A had higher value of MPV than group B and control group.
(Table 3 below)

Table 3: Comparison Of Mean Mpv Between Different Groups

Groups	Mean Platelet Count (Lakhs/cumm)	Mean MPV (fl)
Group A	0.64±0.17	10.2±0.9
Group B	0.52±0.13	8.7±0.35
Control	1.72±0.12	9.1±0.55

To find the statistical significance, Z test was applied on all groups. Group A vs control, group B vs control and group A vs group B showed a z- value of 5.5, 6.6 and 18.75 respectively. All had $p<0.00001$ which was highly significant. There was no significant variation in mean MPV.

DISCUSSION

Thrombocytopenia occurs mainly due to peripheral hyperdestruction of platelets or hypoproduction by bone marrow. Major cause of hyperdestruction of platelets is immunological where antibodies against platelets destroy them while hypoproduction of platelets occur due to bone marrow suppression.[10]

In the present study, 50.6 % cases of thrombocytopenia were observed in females. Study conducted by Nagesh, Tsegaye & Medhin (2016) showed most cases of ITP in females while males were predominant in hypoproductive group.[7] Study conducted by Baheti, Nikumbh & Desai (2018) showed a male preponderance.[1]

Most common age group in the present study showing throm bocytopenia was 21-30 years (20.4 %) followed by 31-40 years (20 %). Study by Baheti et al. (21-40 years = 38% cases) and A. Shah, Chaudhari & M. Shah (2013) (15-49 years = 47% cases) showed similar results. [1,12]

Cases of hyperdestructive thrombocytopenia were more in the present study (78.6 %). Similar results were seen in studies conducted by Bhat, Goveas & Jayaprakash (2020) (59% cases of Hyperdestructive thrombocytopenia) and Kharikar, More, A. Pandey & M. Pandey (2016) (69 % cases of Hyperdestructive thrombocytopenia). [3,6]

Most common cause of thrombocytopenia in the present study was bacterial infections (27.1%). Studies by Kharikar et al. (bacterial infection = 28.4 % cases) and Sajwani & Tunaiji (2014) (infections = 28.3 % cases) had similar results.[6,11] Baheti et al. encountered maximum cases of anemia (42 %) followed by infections (39 %).[1]

The present study showed that MPV in hyperdestructive thrombocytopenia (group A) was comparatively higher than hypoproductive thrombocytopenia (group B) and control group. Similar results were observed in studies conducted by Bhat et al. and Kharikar et al., which showed the cut-off value of 9.56 fl and 10.46 fl for hyperdestructive thrombocytopenia respectively (Both studies had $p<0.001$).[3,6]

The present study showed highest MPV in ITP cases (12.02 fl). Similar results were obtained by Ntaios et al. (2008), Numbenjapon et al. (2008) and Shah et al.[8,9,12]

Bone marrow examination is considered as gold standard for differentiating between categories of thrombocytopenia. But it is a painful and tedious procedure.[6]

According to many studies, MPV along with various platelet parameters like PDW, PCT and P-LCR are emerging potential markers to differentiate between categories of thrombocytopenia.

The present study may have its own limitations since other platelet parameters were not taken into consideration. Studies combined with other platelet indices may yield more promising results.

CONCLUSION:

Although bone marrow examination remains the gold standard, MPV can be used as an efficient tool to help differentiate hyperdestructive thrombocytopenia from hypoproductive thrombocytopenia. It would spare the patients from painful biopsy and is also cost effective as automated hematology analyzers present in laboratories give accurate measurement of MPV and other platelet indices. The results of the present study are statistically significant which prove that MPV is a reliable parameter.

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